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Different Scales of Network Organization Detected by fMRI During Motor Tasks

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There is growing evidence that functional groups of neurons in the neocortex are spatially localized into networks, which themselves are part of larger networks. Recently, Anderson and Sutton (1995) developed a computational model to investigate dynamic clustering within and between different scales of neocortical organization. Based on the models' predictions and the utility of weight maps to encode distributed information in artificial neural networks, we hypothesized that networks nested within other networks could be detected from experimental data involving multiple tasks.

Using T2* BOLD fMRI signals during six motor tasks in the human, we determined the weight maps involving all pairs of voxels across the tasks (Sutton et al., 1996). No assumptions were made about anatomy. The maps revealed a fully connected network in the region of M1, as expected by the tasks. As predicted by the model, this network was nested with a large, fully connected network two orders of magnitude larger. The large network had nodes at bilateral M1, bilateral S1 and supplementary motor cortex. While preliminary, this work supports the notion that the neocortex is partially organized into dynamic networks nested within other networks.

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